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LLNL-TR-665625

National Ignition Facility (NIF) FY2015 Facility Use Plan

P. Folta

December 19, 2014

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December 18, 2014

NIF-0176088

Dr. Keith LeChien
Director
Office of Inertial Confinement Fusion, NA-112
National Nuclear Security Administration
U.S. Department of Energy
Forrestal Building
1000 Independence Ave., S.W.
Washington, DC 20585

Subject: NNSA Level 2 Milestone MRT 5363: Deliver the NIF FY15 Facility Use Plan

Dear Dr. LeChien,

This letter documents completion of MRT L2 milestone 5363 *Deliver the NIF FY15 Facility Use Plan*, due 12/2014.

The milestone exit criterion is as follows: "Complete when the FY15 NIF Facility Use Plan has been delivered to NNSA."

In support of completion of this milestone, LLNL is submitting the attached NIF FY15 Facility Use Plan, Version 1.0. The plan identifies allocated target shot days in the following programs:

- Stockpile Stewardship Program – High Energy Density Science (SSP-HED)
- Stockpile Stewardship Program – Inertial Confinement Fusion (SSP-ICF)
- National Security Applications (NSA)
- Discovery Science (DS)

The plan also supports activities in the following areas:

- Diagnostic and New Capability Development
- Laser Performance
- Facility Maintenance and Reconfiguration
- Routine Maintenance
- Advanced Radiographic Capability (ARC) Commissioning

The Plan includes approximately 300 target shots, consistent with guidance provided by NNSA, the HED Council, and the ICF Council. Over 90% of planned shots support the Stockpile Stewardship Program, with a majority dedicated to non-ignition experiments in direct support to the SSP.

The Plan assumes total FY2015 LLNL ICF Program Funding of \$329M. The Plan will be revised in the event of a lapse in FY2015 federal appropriations, or if NNSA provides FY2016 budget guidance at a significantly reduced level from FY2015.


As was the case in FY2014, the NIF Director and the NIF staff have worked closely with program leadership and the user community to develop the FY2015 Plan. Consistent with the NIF Governance

Plan, a call for proposals process was used to solicit potential experiments for all user programs. Technical peer reviews and facility feasibility/readiness reviews were then conducted with results provided to program leadership and the NIF Director. The Plan was reviewed at various stages with the newly-formed Facility Advisory and Scheduling Committee, composed of managers from each program and NNSA site.

This letter and enclosure constitute formal submission of required documentation in support of completion of NNSA Level 2 Milestone MRT 5363 by the Principal Associate Director for NIF and Photon Science.

Please let me know if you have any questions or concerns.

Sincerely,


Dr. P. Jeff Wisoff
Principal Associate Director
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National Ignition Facility (NIF) FY2015 Facility Use Plan Version 1.0

December 2014

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Approval and Concurrence

Submitted:



Dr. Mark Herrmann
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Date

Concurred:



Dr. P. Jeffrey Wisoff
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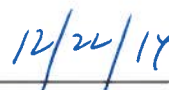


Date

Approved:



Dr. William Goldstein
Director
Lawrence Livermore National Laboratory



Date

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National Ignition Facility (NIF) FY2015 Facility Use Plan

I. Summary

Major features of the FY2015 NIF Use Plan include:

- Performing a record number of layered DT experiments with 28 planned compared with 15 in FY2014. Executing the first plutonium experiments on the NIF in support of the Science Campaigns.
- Over 300 targets shots, a 57% increase compared to FY14. This is a stretch goal defined in the 120-Day Study document, and relies upon the success of many shot-rate improvement actions, as well as on the distribution of shot type selected by the users. While the Plan is consistent with this goal, the increased proportion of layered DT experiments described above reduces the margin against this goal.
- Commissioning of initial ARC capability, which will support both SSP-HED and SSP-ICF programs.
- Increase in days allocated to Discovery Science to a level that supports an ongoing program for academic use of NIF and an annual solicitation for new proposals.
- Six Facility Maintenance and Reconfiguration (FM&R) periods totaling 30 days dedicated to major facility maintenance and modifications.
- Utilization of the NIF Facility Advisory Schedule Committee (FASC) to provide stakeholder review and feedback on the NIF schedule.

The Use Plan assumes a total FY2015 LLNL NIF Operations funding in MTE 10.7 of \$229.465M and in MTE 10.3 of \$47.0M. This Use Plan will be revised in the event of significant changes to the FY2015 funding or if NNSA provides FY2016 budget guidance significantly reduced compared to FY2015.

II. NIF Activities in FY2015

FY2015 NIF experiments will support the following areas:

- *SSP-High Energy Density (HED) Science*: This includes HED science work sponsored by the Science Campaigns, Directed Stockpile Work, and other NNSA programs in support of the SSP.
- *Stockpile Stewardship Program (SSP)-Inertial Confinement Fusion (ICF)*: This includes work sponsored by the National Nuclear Security Administration (NNSA) ICF Campaign in support of the program to demonstrate ignition on NIF.
- *Discovery Science (DS)*: This includes work aimed at exploring fundamental scientific questions in materials science, planetary physics, astrophysics, and other areas.

- *National Security Applications (NSA)*: This includes national security work in areas other than the SSP, sponsored by agencies such as the Department of Defense (DoD) and the NNSA Office of Nonproliferation (NA-20).

In addition to executing target shots in support of the above programs, the facility will also conduct the following activities to meet user needs:

- *Diagnostic and New Capability Development*: Development of new diagnostics and other new capabilities that support user and facility needs. In FY15 we are allocating resources to new capabilities based on community input obtained in FY14. For new capability development in FY16 and beyond there will be a formal call for proposal process for developing new facility capabilities that has been developed in consultation with NNSA HQ and the ICF execs.
- *Laser Performance*: This includes calibration shots, frequency conversion crystal conditioning, and efforts aimed at increasing facility efficiency and maintaining 192 beams with the required power, precision, and reproducibility for user experiments.
- *Facility Maintenance and Reconfiguration*: This includes facility and laser maintenance work, diagnostic upgrades, and other activities requiring additional focused time and significant effort beyond routine maintenance.
- *Routine Maintenance*: Two days a week are dedicated to typical routine maintenance activities, normally “invisible” to the user community, including exchange of final optics, alignment system calibrations, refurbishment of high voltage switches, regenerative amplifier alignment, IT upgrades, control system upgrades and security patching, lubrication of movable/adjustable components (target positioner drives, roving mirrors, DIM motion drives, etc.) and maintenance of the target area (cryogenic systems, target chamber and gate valves, target positioner systems, other). Weekly maintenance days were moved to Fri-Sat to better support facility and science activities. Routine maintenance is performed with a small operational staff and also done in parallel with shot operations during the 5-day shot week.
- *ARC Commissioning*: Approximately 5 facility shot days have been allocated to Advanced Radiographic Capability (ARC) commissioning activities in FY2015. ARC commissioning will generally be performed during maintenance periods, FM&Rs and other times in parallel with shot operations to minimize the effects on target shots.

III. Overview of the FY2015 Use Plan

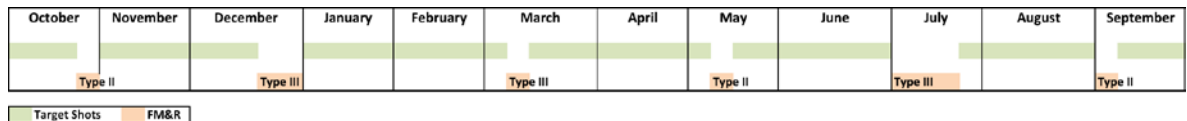


Figure 1: Timeline of major FY2015 NIF activities.

Beginning in FY15, program allocations were given in units of days instead of shots to allow greater autonomy in determining how each program would best use their time. Figure 1 outlines major activities by month. Approximately 223 days have been allocated for shot operations with most of this time dedicated to target shots. This is a 27% increase over FY14 shot days. Of the 20 days held in reserve by the NIF Director, 13 have been allocated to meet programmatic and facility priorities. Barring any major facility issues, the intent is to utilize this reserve for target shots. Thirty days will be devoted to FM&R activities. Table 1 below summarizes the resulting distribution of facility time.

Table 1: Proposed FY2015 NIF Use Plan sorted by categories in Section II.

Category	Total Days	Comment
Shot days	223	Laser-only shots for conditioning, calibration, and new capabilities commissioning will also be performed during shot weeks, generally planned in parallel with DIM reconfiguration to minimize impact on target shots.
HEDSSP	85	Consistent with NNSA guidance that ~ 40% of program shots will be in support of HEDSS with priorities established by HED Council
ICFSSP	79	
NSA	13	
DS	18	
Diagnostic & New Capabilities	21	Includes Diagnostic and ARC commissioning shots
NIF Director's Reserve	7	13 days have been allocated to meet programmatic and facility priorities.
Laser Performance		Included in counts above
FM&R	30	Days in each FM&R: Nov (2), Dec/Jan (6), Mar (5), May (2), July (12), Sept (3)
Routine Maintenance	104	Routine maintenance, optics exchanges and diagnostics reconfiguration
Holidays	8	Thanksgiving (1), Dec/Jan Winter (4), Memorial Day (1), Independence Day (1), Labor Day (1)
Total	365	

Under present planning assumptions, NIF plans to conduct 309 target shots in FY2015. Consistent with NNSA planning guidance 40% of planned target shots are devoted to non-ignition SSP-HED activities, as prioritized by the HED Council. The national Indirect-Drive and

Polar Drive working groups determined priorities for SSP-ICF experiments.

Table 2 summarizes planned shots by program and by quarter. Unallocated Director Reserve time is not indicated in this table. Tables 1 and 2 serve as the basis for formulation of the FY2015 NIF schedule. The schedule was reviewed by the FASC before placing under configuration control. A Schedule Change Request (SCR) process manages changes to the schedule. Changes to the schedule or the Use Plan itself will be made based on user requests and facility needs, and will be coordinated with the affected programs and researchers, and the facility. The FY2015 schedule is available online at <https://lasers.llnl.gov/for-users/nif-calendar>. Further information on the schedule and the Use Plan is available from the NIF User Office.

Table 2: FY2015 NIF shots by program and by quarter.

Program	Q1	Q2	Q3	Q4	FY15 Total
HED	32	29	36	34	131
ICF	27	44	21	15	107
DS	7	7	17	6	37
NSA	5	3	10	3	21
Facility	2	2	4	5	13
FY15 Planned Shots	72	85	88	61	309

IV. Facility Maintenance and Reconfiguration (FM&R) Periods

NIF FM&R periods are broken into three categories depending on impact:

- Type I: Does not impact shots
- Type II: Duration less than 3 days
- Type III: Duration over 3 days

Type I FM&Rs occur during regular maintenance days or concurrent with shot days. NIF typically requires 4-5 Type II/Type III FM&R periods per year to maintain its capability. These FM&R periods include:

- Preventive maintenance and reactive repairs of facility, infrastructure, laser and target experimental equipment
- Installation and commissioning of new capabilities or upgrades for the diagnostics, experimental capabilities or laser/control systems
- Optics maintenance and exchanges
- Restart, optics conditioning and facility revalidation shots prior to commencement of target shots

FY2015 FM&R work scope is summarized below.

October/November 2014 FM&R Type II (2 days):

Primary activities during this FM&R include an ICCS software controls release and related regression shots to verify ARC shot capability, ARC compressor vessel interior beam path build-out, upgrade of the current VISAR / Neutron Imaging System with M1/M2 mirror reconfiguration, and Argon Pad “configured item” maintenance. Shots will resume after target alignment commissioning is performed on the subsequent routine maintenance days of October 31 and November 1, 2014.

December/January Type III FM&R (6 days):

The December FM&R includes implementation of diagnostic fore-line vacuum automation for faster diagnostic instrument manipulator pump-and-vent and shorter diagnostic recovery/reconfiguration durations; Spatial Filter 4 Lens and Tower Line Replaceable Unit refurbishment, Laser Mirror 8 refurbishment on selected quads, commissioning of the Neutron Imaging System in the dual use VISAR/NIS diagnostic instrument manipulator, and large positioner maintenance including inspection of the target alignment sensor mechanism. During this FM&R we will also start implementing the first phase of the NIF HVAC control system upgrade, starting with the central plant controls.

March FM&R Type III (5 days):

The FM&R includes a significant ICCS software release and regression test, upgrade of the RP01 target chamber vacuum pump, installation of the chiller for the CryoTarpos X-ray systems, and installation of upgraded calorimeters in the roving mirror diagnostic enclosure (RMDE). During the two maintenance days following the FM&R we perform a DIM based laser calibration of the NBI scatter plates.

May FM&R Type II (2 days):

This short maintenance period will allow an ICCS software release and regression test, an exchange of the IT Network switches, as well as an upgrade of the neutron imaging camera. Re-commissioning will be completed on the regularly scheduled maintenance days following the FM&R.

July FM&R Type III (12 days):

During the July FM&R we will vent the Target Chamber and perform an entry into the chamber using the target chamber service system. At this time, the diagnostic instrument manipulator at the pole (0,0) of the chamber will be upgraded, and the infrastructure for the North Pole neutron time of flight diagnostic will be installed. The full aperture backscatter (FABS) diagnostics will be upgraded for improved neutron mitigation. Argon will be vented from the facility, to allow inspection of the Tower Spatial Filter LRUs as well as entry into the roving mirror diagnostic enclosure (RMDE) for remaining calorimeter replacements. Significant work is also planned on the new high contrast ARC front end laser system during this time. Work will also continue on the HVAC control system upgrade.

Sept FM&R Type II (3 days):

The final FM&R of FY15 will allow for the last ICCS software package to be deployed and regression tested. An upgrade of the Basler NBI cameras will be performed. IT maintenance is planned on the following regularly scheduled maintenance days.

V. Advanced Radiographic Capability (ARC)

ARC is needed for the SSP-HED Complex Hydrodynamics and Material Properties campaigns, and the SSP-ICF campaign. The initial ARC capability will be 2 NIF beams, each of which contains 2 ARC “beamlets.”

Platform development using the ARC was delayed due to issues with the level of pre-pulse originating from the front end. Figure 2 illustrates the revised plan for ARC installation and commissioning, which includes the development of a high contrast front end.

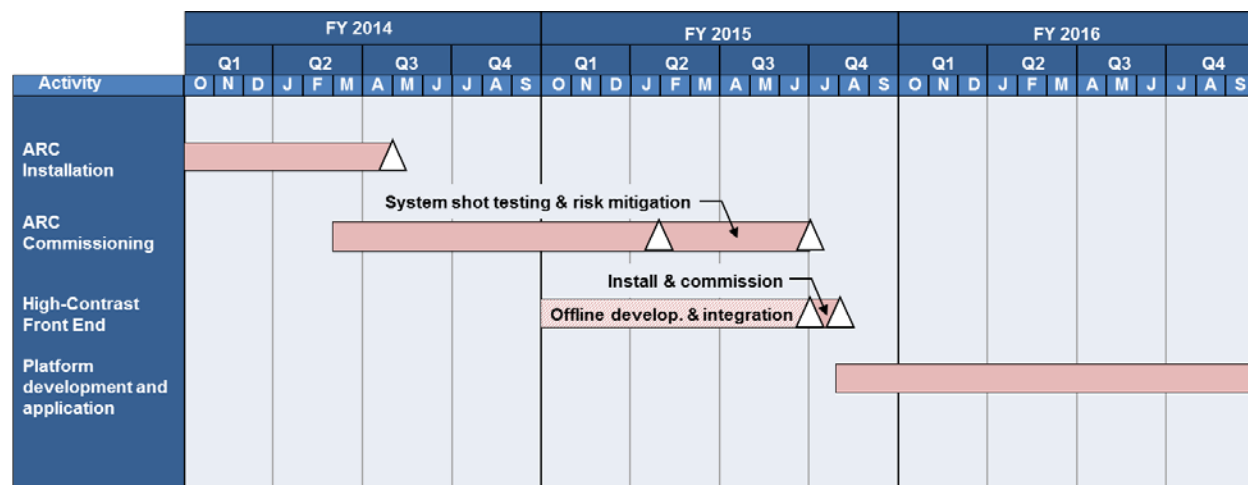


Figure 2: Planned schedule for ARC activities.

VI. Summary

The FY15 Facility Use Plan meets NNSA guidelines and is responsive to the Programs. The Plan significantly increases both the number of layered shots as well as the total shots well beyond the FY14 numbers. This aggressive increase in shots relies on the implementation of a number of recent shot rate improvements to meet the >300 stretch goal established in the 120-Day Study. The Plan puts the Discovery Science Program on steady footing, realizes the commissioning of ARC, and provides for a number of new diagnostics and capabilities.

The Plan includes the establishment of the FASC to help enable formal stakeholder review and feedback, an SCR process to manage the shot schedule and provide for appropriate review, and a standard Friday-Saturday maintenance period to better support the operational and science activities.

Changes to the Plan will be made based on user requests and facility needs, and will be coordinated with the affected programs and researchers, and the facility. The Plan is available from the NIF User Office.